REMARKS

Claims 1-5 and 8-16, as amended, remain herein. Claims 1, 2 and 16 have been amended. Support for the amendments may be found throughout the specification. See, e.g., page 11, lines 17-19; page 12, lines 15-19; page 8, line 22 to page 9, line 4; and page 9, line 24 to page 10, line 2 of applicants' specification).

1. Claims 1-4, 6-10 and 14-16 were rejected under 35 U.S.C. § 103(a) over Shirasaki et al. U.S. Patent 5,834,894 in view of Okada et al. US Patent Application Publication 2002/055014, further in view of Matsushima et al., *Current Applied Physics* **2005**, 5, 305-308; Bernede et al., SCELL-2004 International Conference on Physics, Chemistry and Engineering of Solar Cells, Badajoz, Spain (2005), 87, 261-270; and Wu et al., Advanced Materials (2008), 20, 2359-2364.

Applicants' claims 1, 2 and 16 recite an organic electroluminescence device comprising a cathode, an anode, at least one layer comprising a phosphorescent light emitting material and a host material which is sandwiched between the cathode and the anode, and an electron injecting layer adhered directly to the light emitting layer, wherein the host material is predominantly an electron transporting material having an electron mobility of 10^{-5} $cm^2/V.s$ or greater, and the organic electroluminescence device does not include a hole blocking layer.

Shirasaki does not disclose applicants' claimed organic electroluminescence device. Shirasaki uses a fluorescent not a phosphorescent dopant. A person of ordinary skill in this art would know that fluorescent and phosphorescent dopants are not directly substitutable. For instance, a person of ordinary skill in this art would add a hole blocking layer to minimize the

quenching of the light emission from excimers in the triplet state (see applicants' specification at page 3, line 11 to page 4, line 14). In addition, Shirasaki does not disclose applicants' host material for the light emitting layer which is predominantly an electron transporting material having an electron mobility of 10^{-5} $cm^2/V.s$. Instead, Shirasaki discloses PVCz as the host material, which is a known hole transporting material and has poor electron mobility or transporting properties. Applicants' specification explains:

> With regard to the host material in the light emitting layer, conventionally employed polycarbazole compounds such as polyvinylcarbazole or biscarbazole has hole transporting capability exclusive of exception, and at the same time, has little electron transporting capability. In an occasion of employing the above hole transporting material as the host material, a cathode side interface of the light emitting layer becomes the main recombination zone. In this occasion, adhering the electron injecting layer with the light emitting layer as well as intervening the electron injecting layer between the light emitting layer and the cathode and adding the electron transporting material with an energy gap smaller then the energy gap forming the light emitting layer into the electron injecting layer will deactivate the excitation state generated mainly on the cathode side interface of the light emitting layer, and as a result, only the EL device with extremely low efficiency is obtained. Further, in an occasion of employing the electron transporting material with the triplet energy for forming the electron injecting layer smaller than the triplet energy of the host material forming the light emitting layer, the excitation state generated mainly on the cathode side interface of the light emitting layer will be deactivated by the electron injecting layer, and as a result, only the EL device with extremely low efficiency is obtained.

Applicants' specification, page 11, line 20 to page 12, line 14 (emphasis added here).

Okada does not teach or suggest what is missing from Shirasaki. First, a person of ordinary skill in this art would not be motivated to combine Shirasaki and Okada directly. Instead, the person of ordinary skill in this art would, as Okada does, use a hole blocking layer to minimize the quenching of the light emission from excimers in the triplet state. In addition, Okada also fails to disclose and says nothing about applicants' host material for the light emitting layer which is predominantly an electron transporting material having an electron

mobility of 10^{-5} cm^2/V.s. Instead, Okada discloses the use of CBP as the host material, which is predominantly a hole, not an electron, transporting material (the hole mobility of CBP is higher than its electron mobility).

Applicants' claimed invention, is not obvious and eliminates the need to use a hole blocking layer. As explained in applicants' specification:

> However, it was found that the conventional constructions for electron injection have problems. Namely, because the hole blocking layer has large energy gap, and because it works with great resistance as an energy barrier for charge injection transport from the other layer, the driving voltage elevated. Further, although many compounds used for the hole blocking layer held favorable hole barrier capability, they tended to deteriorate, and failed to provide an organic EL device with long lifetime.
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> ...
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> As the result of intensive researches and studies to achieve the above object by the present inventors, the first aspect of the present invention provides an organic EL device, which comprises an light emitting layer consisting of at least phosphorescent light emitting material and a host material, a cathode, and an electron injecting layer adhered to the light emitting layer and at the same time sandwiched between the light emitting layer and the cathode, without employing any hole blocking layer. Further, the first aspect of the invention made the energy gap of electron transporting material in electron injecting layer smaller than that of the host material in the light emitting layer. According to the conventional comprehension by the persons skilled in the art, the above settlement will let the electron injecting layer deactivates the excitation state generated in the light emitting layer and only the EL devices with extremely low efficiency will be provided. In the present invention, however, enabling the light emitting layer electron transporting, an electron-hole recombination zone will separate from the interface between the electron injecting layer and the light emitting layer resulting in avoidance of deactivation. Besides, an EL device with high efficiency without the use of the hole blocking layer in the conventional organic EL device is provided by making the ionization potential of the host material 5.9 eV or lower in order to enable holes easily inject into the host material in the light emitting layer. Further, the driving voltage can be decreased because the holes are injected into the host material in the light emitting layer thereby allowing the transportation, and an organic EL device with long lifetime can be obtained because any hole blocking layer that easily deteriorates is not employed. Furthermore, the organic EL device is easily producible because its constitution became simple. Moreover, it was ensured that the energy gap of electron transporting material in electron injecting layer smaller than that of the host material in the light emitting layer has also an effect of promoting injection of electrons from cathode as well as decreasing the driving voltage.

Applicants' specification at page 4, lines 8-14 and page 5, line 16 to page 6, line 21 (emphasis

added here). See also applicants' specification at page 3, line 11 to page 4, line 14 (explaining that a hole blocking layer is typically used in phosphorescent devices to prevent the quenching of triplet excited states and to achieve sufficient device efficiency).

By using a host material for the light emitting layer which is predominantly an electron transporting material, applicants' organic electroluminescence device achieves superior efficiency of light emission under lower voltage, and eliminates the need for a hole blocking layer. See page 12, lines 15-19 of applicants' specification ("On the other hand, because the light emitting layer has electron transporting capability in the present invention, an electron-hole recombination zone will separate from the interface between the electron injecting layer and the light emitting layer, resulting in avoidance of deactivation of the generated excitation state.") (emphasis added here).

Applicants' specification directly compares applicants' claimed host material to Okada's CBP (compare applicants' Examples 3-5 to Comparative Examples 1-3 and 5 in Table 1 at page 88 of applicants' specification). This comparison shows that if a person of ordinary skill in this art were to directly combine Shirasaki and Okada, without using a hole blocking layer, the resulting device will exhibit poor efficiency of light emission because of the quenching effect discussed above (see page 78, lines 5-11; page 79, lines 7-15; page 83, lines 4-7; and page 86, lines 12-19 of applicants' specification).

Evidence of long felt but unsolved needs and failure of others (see MPEP § 2145 citing Graham v. John Deere Co., 383 U.S. 1, 17 (1966)), and evidence that the claimed invention yields unexpectedly improved properties or properties not present in the prior art (see MPEP § 2145 citing In re Dillon, 919 F.2d 688, 692-93 (Fed. Cir. 1990)), rebut alleged obviousness.

Applicants' claimed invention solves a long felt problem by eliminating the need for a hole blocking layer and yields unexpected results by achieving great efficiency of light emission without the use of a hole blocking layer, (compare applicants' Example 5 and Comparative Example 6 at Table 1, page 88 of applicants' specification (showing that Comparative Example 6 required higher voltage to achieve about the same efficiency of light emission)).

Applicants' claim 2 is further patentable because it recites that a triplet energy of the electron transporting material in the electron injecting layer is smaller than that of the host material in the light emitting layer. Contrary to the assertion in the Office Action, the triplet energy of Alq (2.51 eV (see Table 1 at page 88 of applicants' specification)) is not smaller than that of Shirasaki's PVCz (2.5 eV).

Thus, applicants' claims are not obvious over Shirasaki in view of Okada. Furthermore, Shirasaki and Okada disclose nothing that would have suggested applicants' claimed invention to one of ordinary skill in the art. There is no disclosure or teaching in any of Shirasaki, Okada, or anything else in this record, that would have suggested the desirability of modifying or combining any portions thereof effectively to anticipate or suggest applicants' presently claimed invention. Applicants respectfully request reconsideration and withdrawal of this rejection.

2. Claims 5 and 11-13 were rejected under 35 U.S.C. § 103(a) over Shirasaki in view of Okada as evidenced by Matsushima, Bernede, and Wu. Claims 5 and 11-13 depend, directly or indirectly, from claim 1.

As discussed above neither Shirasaki nor Okada teaches or suggests applicants' claim 1. Thus, applicants' claims 5 and 11-13 are not obvious over Shirasaki in view of Okada.

Furthermore, Shirasaki and Okada disclose nothing that would have suggested applicants' claimed invention to one of ordinary skill in the art. There is no disclosure or teaching in any of Shirasaki, Okada, or anything else in this record, that would have suggested the desirability of modifying or combining any portions thereof effectively to anticipate or suggest applicants' presently claimed invention. Applicants respectfully request reconsideration and withdrawal of this rejection.

3. Claim 2 was rejected under 35 U.S.C. § 103(a) over Fujino et al. JP 2000-169448 in view of Okada as evidenced by Tanaka et al., *Japan Journal of Applied Physics* **2003**, 42, 2737-2740.

Applicants' claim 2 recites an organic electroluminescence device comprising a cathode, an anode, at least one layer comprising a phosphorescent light emitting material and a host material which is sandwiched between the cathode and the anode, and an electron injecting layer adhered dire ctly to the light emitting layer, wherein the host material is predominantl y an electron transporting material having an electron mobility of 10^{-5} $cm^2/V.s$ or greater, and the organic electroluminescence device does not include a hole blocking layer.

Fujino does not disclose applicants' claimed organic electroluminescence device. The Office Action admits that Fujino does not teach a phosphorescent dopant in the light emitting layer but states that Okada teaches phosphorescent dopants. As explained above, a person of ordinary skill in this art would not directly substitute a fluorescent with a phosphorescent dopant. In addition, host materials which are suitable for fluorescent dopants may not be suitable for phosphorescent dopants (see, for instance, Wu at page 1, column 2, lines 1-8).

As explained above, a hole blocking layer is typically used in phosphorescent devices to prevent the quenching of triplet excited states and to achieve sufficient device efficiency (applicants' specification at page 3, line 11 to page 4, line 14).

As discussed above, applicants' organic electroluminescence device is not obvious. Applicants' organic electroluminescence device eliminates the need for a hole blocking layer and achieves superior efficiency of light emission under lower voltag, by using a host material for the light emitting layer which is predominantly an electron transporting material. Fujino and Okada, on the other hand, both disclose predominantly hole transporting materials as the host material for the light emitting layer (see above, and see Fujino at paragraphs [0046] and [0074] of the English translation (stating that the amino compound of formula (I) "is excellent in the charge transport function, especially the positive hole transportation function"). Thus, Fujino and Okada do not disclose applicants' claimed host material, and teach away from applicants' claimed invention.

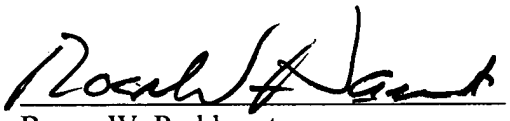
Thus, applicants' claims are not obvious over Fujino in view of Okada. Furthermore, Fujino and Okada disclose nothing that would have suggested applicants' claimed invention to one of ordinary skill in the art. There is no disclosure or teaching in any of Fujino, Okada, or anything else in this record, that would have suggested the desirability of modifying or combining any portions thereof effectively to anticipate or suggest applicants' presently claimed invention. Applicants respectfully request reconsideration and withdrawal of this rejection.

Accordingly, all claims 1-5 and 8-16 are now fully in condition for allowance and a notice to that effect is respectfully requested. The PTO is hereby authorized to charge/credit any fee deficiencies or overpayments to Deposit Account No. 19-4293. If further amendments would place this application in even better condition for issue, the Examiner is invited to call applicants' undersigned attorney at the number listed below.

Respectfully submitted,

STEPTOE & JOHNSON LLP

Date: August 31, 2009



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